



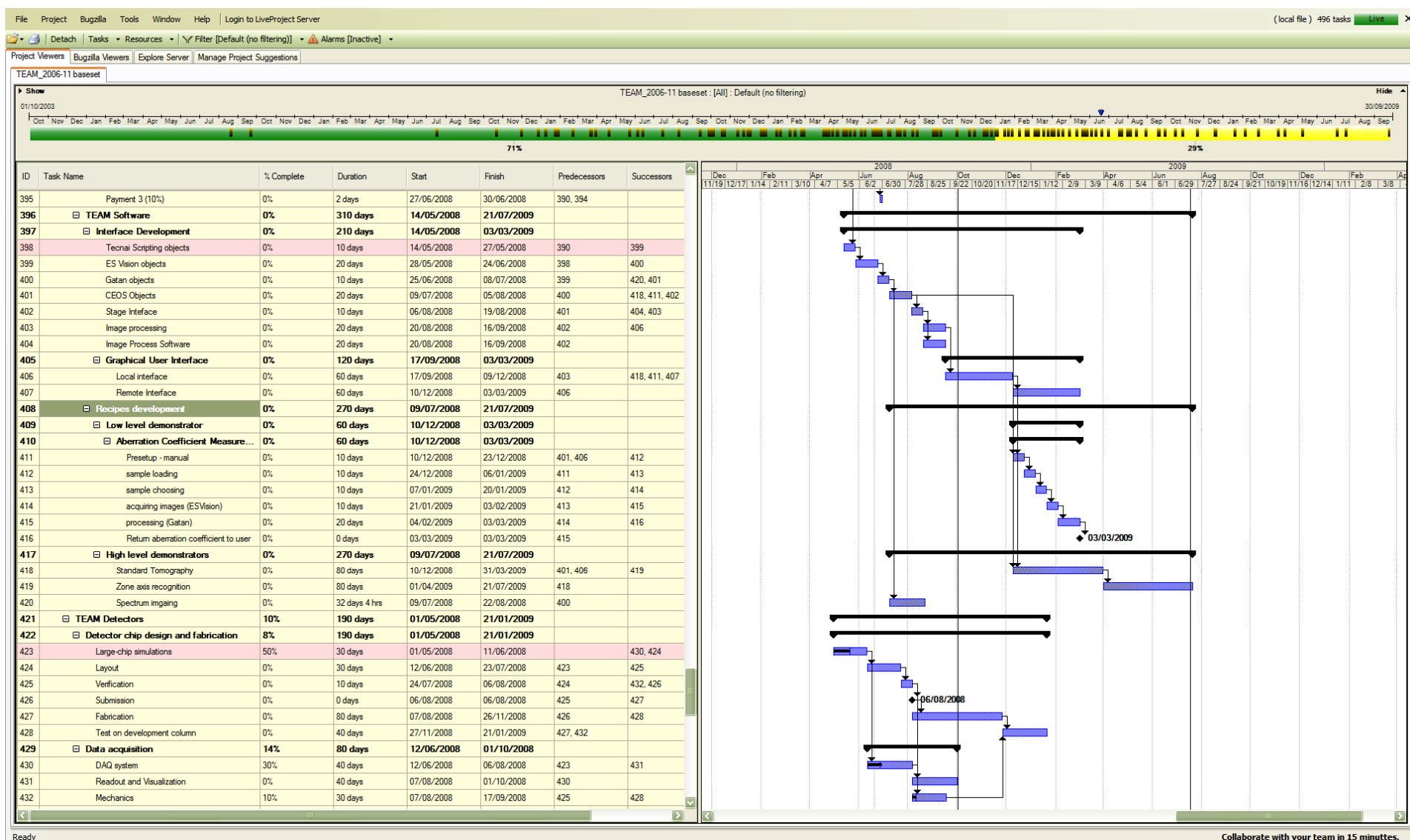
TEAM Software

Quentin Ramasse – microscopy – software integration
Earl Cornell – software engineering



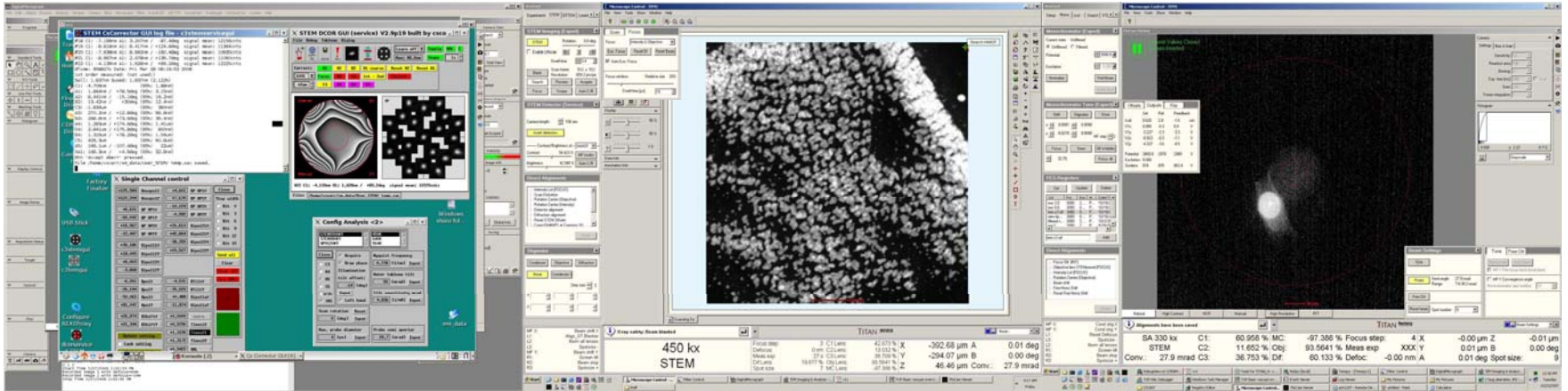


TEAM Software





Multiple interfaces

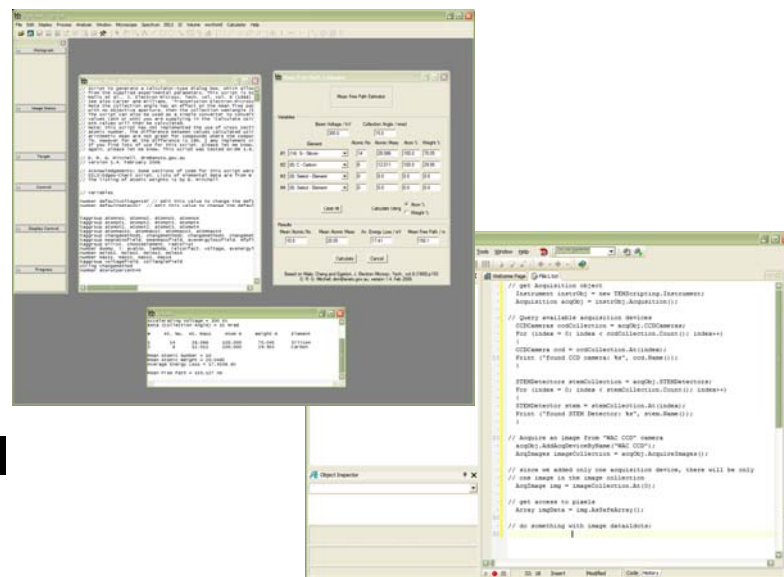
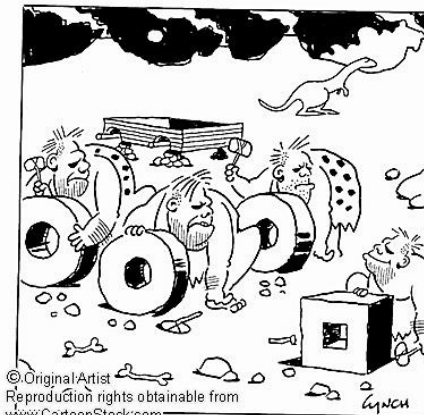


- Manufacturers' interfaces:
 - FEI (ES Vision, TEM Server): microscope
 - CEOS: aberration control
 - Digital Micrograph: spectroscopy, cameras
- “Home grown” interfaces:
 - Stage
 - Detectors
 - Analysis...



Unified scripting layer

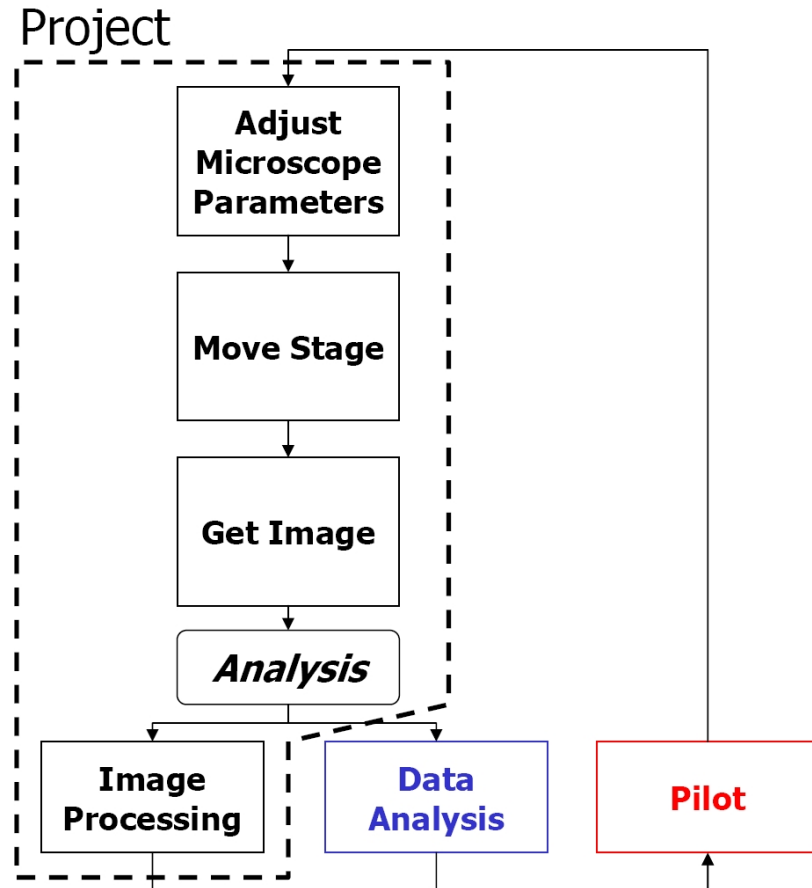
- Existing interfaces are the fruit of years of development: let's not re-invent the wheel!
- Scripting solution:
 - Reprise existing scripting capabilities
 - Easily maintained
 - Easily extended
 - Unified platform for all TEAM partners
 - Ideal for remote control
- Pitfalls:
 - Scripting can be esoteric for non-programming savvy users: additional “simplified” functions
 - Command-line is off-putting: basic GUI





Recipes

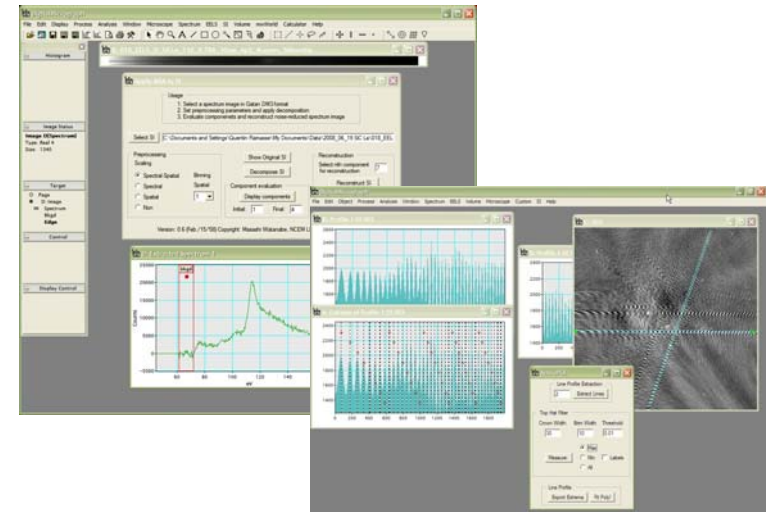
- Re-define a number of functions:
 - Recipes for common cross-platform procedures (acquire image, change format, analyse)
- Automation for complex, repetitive actions (with a view to facilitate lengthy experiments – tomography)
- Long-term: high level scripting functions for ease of use (by-pass programming nitty-gritty)





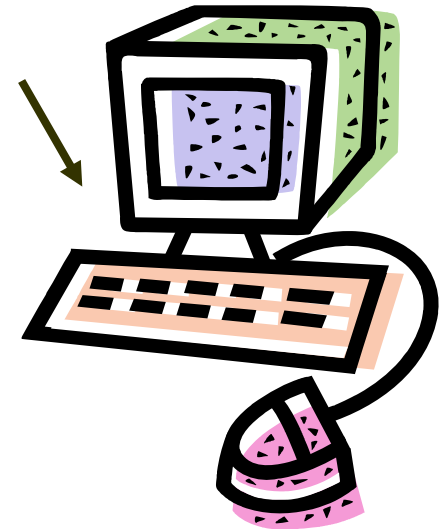
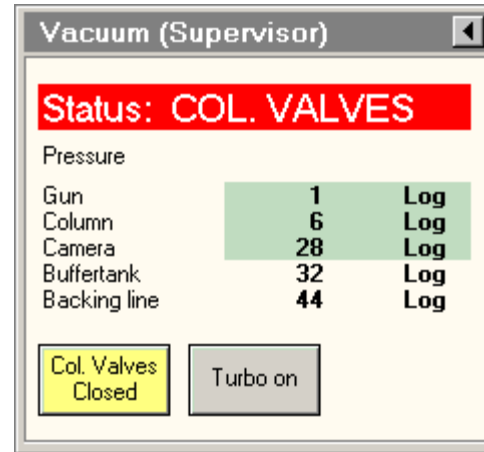
Modular integration

- Initial capabilities (“deliverables”):
 - Standard tomography: C. Kisielowski, M. Rossel
 - Zone-axis recognition: T. Duden, C. Kisielowski
 - Spectroscopy (basic): M. Watanabe
- Integrate additional “modules” as they are being developed (“research”):
 - Advanced stage: T. Duden
 - In-situ stage: UIUC
 - Atomic resolution tomography: C. Kisielowski, M. Rossel
 - Spectroscopy: M. Watanabe
 - Aberration control: Q. Ramasse, A. Lupini
- Third party (e.g. MacTempas)

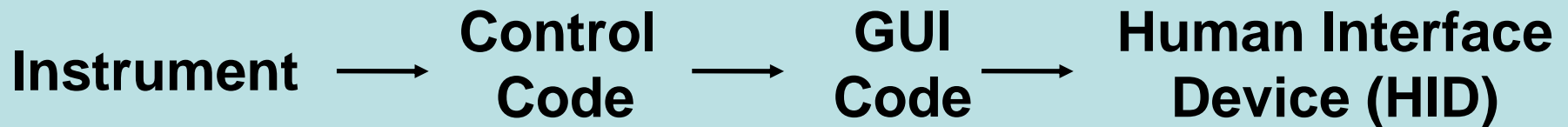




Remote TEAM



```
illuminationPtr  MyIllumination;  
VectorPtr       MyShift;  
double          MyShiftX;  
MyIllumination = MyInstrument->Illumination;  
MyShift        = MyIllumination->Shift;  
MyShiftX       = MyShift->X;
```





Remote TEAM

Via FEI Control Panel Interface

Joy Stick
Track ball
Touch Screen
Etc.



Remote Desktop



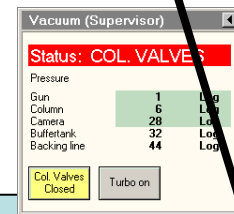
Virtual Network Computing



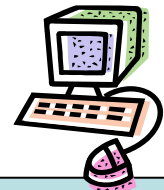
Instrument

```
illuminationPtr  MyIllumination;  
VectorPtr       MyShift;  
double          MyShiftX;  
MyIllumination = MyInstrument->Illumination;  
MyShift        = MyIllumination->Shift;  
MyShiftX       = MyShift->X;
```

**Control
Code**



**GUI
Code**



**Human Interface
Device (HID)**



Remote TEAM

Multi-Client Network Interface for “Objects”

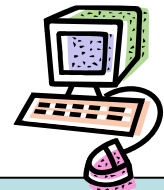
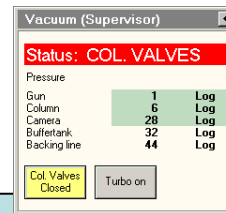
COM interface to microscope
CEOS
Gatan Scripts / GIF
Stage
etc.

Network

New
Remote
GUI



```
illuminationPtr  MyIllumination;  
VectorPtr       MyShift;  
double          MyShiftX;  
MyIllumination = MyInstrument->Illumination;  
MyShift        = MyIllumination->Shift;  
MyShiftX       = MyShift->X;
```



Instrument

Control
Code

GUI
Code

Human Interface
Device (HID)



Automation/Scripting

To make this flexible the scripting language needs access to:

Instrument control (R/W)

Gun

Illumination

Projection

Correctors

Etc.

Image Acquisition

GIF

TIA

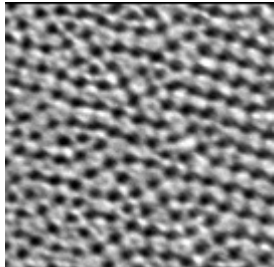
Etc.

Analysis Software

Digital Micrograph

Mac Tempas

Etc.



Get Image



Analyze Image



**Adjust Instrument
and / or Sample**

Iterate as needed



Web interface (PHP)

TEAM Login

Username:

Password:

Gun

Connect to: 'Gun' (Tecnai.Instrument.Gun) . . . Connected

Device: Gun

Tilt	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="button" value="Set"/>
Shift	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="button" value="Set"/>
HTValue	<input type="text" value="25000"/>	<input type="button" value="Set"/>	
HTMaxValue	<input type="text" value="200000"/>		

Gun

Functions for Gun

ID	Variable	Setable	Units	Type	Description	Add
2	Tilt	Yes	-1.0 to +1.0 (logical units)	Vector	The gun tilt alignment values. Range from -1.0 to +1.0 in x and y directions (logical units). The beamblanker changes the gun tilt. Therefore changing the gun tilt alignment is blocked as long as the beamblanker is active.	
3	Shift	Yes	-1.0 to +1.0 (logical units)	Vector	The gunshift alignment values. Range from -1.0 to +1.0 in x and y directions (logical units).	
1	HTValue	Yes	Volts	Double	Set / Get High Tension value for Gun	
5	HTMaxValue	No	Volts	Double	The maximum possible value of the HT on this microscope.	



Visual Studio interface

FEI Control

Gun

☐ Auto Update

HT Max Value

HT Value

HT State

Shift

Tilt

Stage

☐ Auto Update

X (um)

Y (um)

Z (um)

A (deg)

B (deg)

Holder

Status

Illumination

☐ Beam Blanked

Condenser Stigmator

Dark Field Mode

Intensity

☐ Intensity Limit Enabled

☐ Intensity Zoom Enabled

Mode

Rotation Center

Shift (nm)

Spotsize Index

Tilt

☐ Auto Update

Projection

Camera Length

Camera Length Index

Defocus

Detector Shift

Detector Shift Mode

Diffraction Shift

Diffraction Stigmator

Focus

Image Beam Shift

Image Beam Tilt

Image Rotation

Image Shift

Lens Program

Magnification

Magnification Index

Mode

Objective Excitation

Objective Stigmator

Projection Index

Sub Mode

Sub Mode Max Index

Sub Mode Min Index

Sub Mode String

☐ Auto Update

Camera

☐ Auto Update

Exposure Number

Film Text

☒ Is Small Screen Down

Main Screen

☐ Manual Exposure

Manual Exposure Time

Measured Exposure Time

Plate Label Date Type

☒ Plateu Marker

Screen Current

☐ Screen Dim

Screen Dim Text

Stock

Usercode

Vacuum

☐ Column Valve

☐ PVP Running

Status

☐ Auto Update

Name	Pressure	Pres Level	Status
P1	41.528708	LowMediu	Valid
P15	173.37124	High	Valid
P2	411.88080	High	Valid
P3	0.0001266	Low	Valid
P4	1.6797004	Low	Valid
P6	1.333E-06	Low	Valid
P8	1.1248125	Low	Valid

TIA

1 HAADF Detector

2 Unknown

3 Unknown

4 Unknown

ES Vision

Peels: True

CCD: True

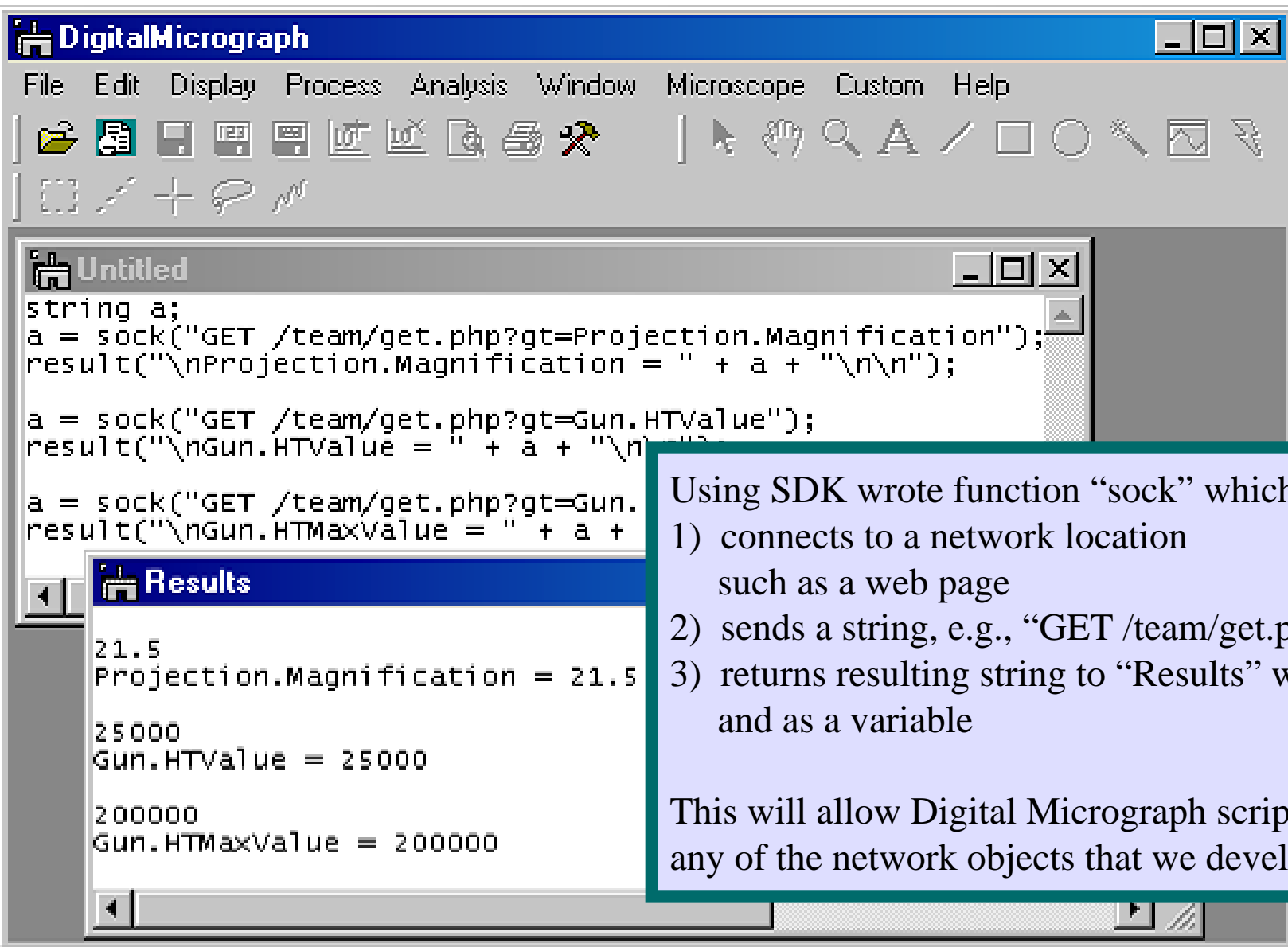
EDX: False

Scan: True

Video: False



Gatan Script access to network “objects”



Using SDK wrote function “sock” which:

- 1) connects to a network location such as a web page
- 2) sends a string, e.g., “GET /team/get.php”
- 3) returns resulting string to “Results” window and as a variable

This will allow Digital Micrograph scripts to use any of the network objects that we develop.